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(54) Head-up display for motorcycle

(57) The invention provides a head-up display suitable for a motorcycle.

An image 31 is present in peripheral fields 49 outside a 90% center field 48. In the case where the image 31 is located outside the 90% center field 48, it does not obstruct the drive of the vehicle, and in the case where the image 31 is located in the peripheral fields 49, it allows a driver to dimly see the shape of the image 31 and thereby recognize the presence of the image 31. For this reason, the image 31 is located in the peripheral fields 49.

Since an image is located in a peripheral field, the presence of the image can be recognized by a driver while not obstructing a desirable visibility to the front side of the driver. The driver can recognized, on the basis of the presence or absence of the image, whether or not attention should be taken to drive of the vehicle.

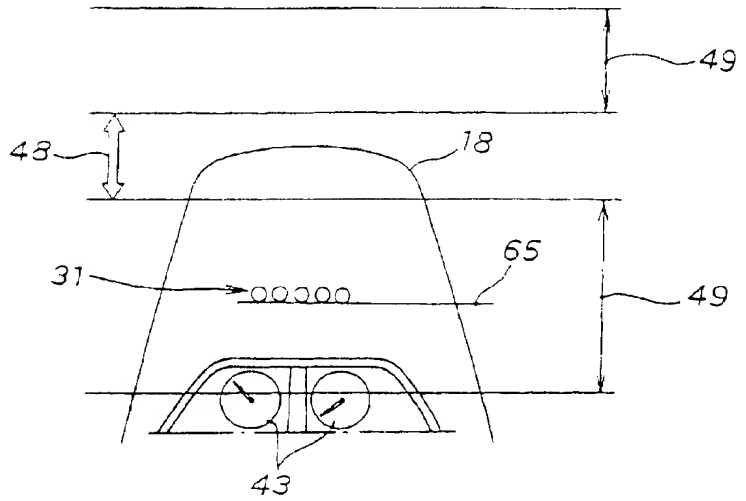

FIG. 6

EP 1 143 286 A1

Description

[0001] The present invention relates to a head-up display for a motorcycle.

[0002] Various methods of allowing a running vehicle to detect the presence of another movable body such as a vehicle approaching thereto have been proposed. For example, Japanese Patent Laid-open No. Hei 2-216600 entitled "Traffic Accident Prevention Method" describes a method of preventing a traffic accident of a relatively large vehicle having three or more wheels. According to this method, a receiver is mounted on the relatively large vehicle, wherein the receiver receives radio waves for warning transmitted from a transmitter of another movable body, detects the presence of the movable body, and informs a driver of the detected result. This document does not describe a concrete means of informing a driver of a warning state. Such a means is generally realized by an acoustic transmission method or an optical transmission method. One example of using a head-up display, which is based on the optical transmission method, will be described below.

[0003] FIG. 8 is a view illustrating a four-wheeled vehicle provided with a prior art head-up display. A head-up display 100 includes a projector 102 built in an instrument panel 101. The projector 102 projects an image 104 on a plane, on the inner side of the vehicle, of a front window glass 103. The image 104 allows a driver to have an outlook therethrough. That is to say, the image 104 does not obstruct the visibility to the front side of the driver.

[0004] The techniques disclosed in the above-described document and shown in FIG. 8 are those applied to three or four-wheeled vehicles. If the above-described head-up display is provided on a motorcycle different from a three or four-wheeled vehicle, there occurs the following problem.

[0005] Since a three or four-wheeled vehicle is kept in a stable posture during running, it puts less burden on a driver in order not to be turned over. However, since a motorcycle must be driven with its balance kept during running, it puts a relatively large burden on a driver in order not to be turned over. From this viewpoint, it is difficult to mount a head-up display, which is designed for a three or four-wheeled vehicle, on a motorcycle.

[0006] An object of the present invention is to provide a head-up display suitable for a motorcycle.

[0007] To achieve the above object, according to an invention described in claim 1, there is provided a head-up display for a motorcycle, which is adapted to inform a driver of traffic information by means of an image projected on a screen provided in front of a riding position of a driver, characterized in that when a visual field for a driver who takes a riding posture and turns his or her eyes to the front side is divided into a central field and a peripheral field surrounding the central field, the image is located in the peripheral field on the screen.

[0008] The central field is defined such that an object in this field is clearly visible, and the peripheral field is defined such that an object in this field is dimly visible. According to the configuration of the invention described in claim 1, since the image is located in the peripheral field, the presence of the image can be recognized by a driver while not obstructing a desirable visibility to the front side of the driver. The driver can recognized, on the basis of the presence or absence of the image, whether or not attention should be taken to drive of the vehicle.

Accordingly, the head-up display according to the invention described in claim 1 is suitable for a motorcycle.

[0009] According to an invention described in claim 2, the image is located at a central position of the peripheral field or a position offset to the central field from the central position of the peripheral field.

[0010] With this configuration, the presence of the image located at a central position of the peripheral field or a position offset to the central field from the central position can be more easily recognized by a driver as compared with an image located at a position other than that described above.

[0011] According to an invention described in claim 3, the image has a stripe or linear pattern.

[0012] With this configuration, the presence of the image having a stripe or linear pattern can be more easily recognized by a driver as compared with an image having a dot pattern. The image having a stripe or linear pattern can be easily formed by collection of dots. Accordingly, this configuration is advantageous in terms of production cost.

[0013] According to an invention described in claim 4, the image has a stripe or linear pattern extending in the horizontal direction; and a length of the image is determined so that an angle formed between two lines extending from a point in the central field to both ends of the image becomes at least 20°.

[0014] An image having a pattern extending longer in the vertical direction tends to easily enter the eyes of a driver and thereby interfere with the driver's view when the driver moves the eyeballs right and left. According to the configuration of the invention described in claim 4, since the image has a pattern extending longer in the horizontal direction, it does not interfere with the driver's view when the driver moves the eyeballs right and left, and further, since an angle formed between two lines extending from a point in the central field to both the ends of the image is set to at least 20°, the visibility can be enhanced.

[0015] Hereinafter, an embodiment of the present invention will be described with reference to the accompanying drawings.

[0016] FIG. 1 is a side view of a motorcycle to which the present invention is applied.

[0017] FIG. 2 is a view showing the principle of a head-up display for a motorcycle according to the present invention.

[0018] FIG. 3 is a view illustrating a central field of a

11/20/2002, EAST Version: 1.03.0002

visual field for a driver riding on the motorcycle according to the present invention.

[0019] FIG. 4 is a view illustrating a peripheral field of the visual field for a driver riding on the motorcycle according to the present invention.

[0020] FIG. 5 is a view showing the principle of control of the head-up display of the present invention

[0021] FIG. 6 is a view, seen from the driver side, of an image formed on a screen of a window shield.

[0022] FIG. 7 is a view of an image formed according to the present invention.

[0023] FIG. 8 is a view illustrating a four-wheeled vehicle including a prior art head-up display.

[0024] FIG. 1 is a side view of a motorcycle to which the present invention is applied. A scooter-type motorcycle 10, which is representative of the motorcycle according to the present invention, is configured such that a front wheel 12 is provided on a front portion of a vehicular body 11; a rear wheel 14 as a drive wheel is vertically movably mounted on a rear portion of the vehicular body 11 via a power swing unit 13; steps 15 are disposed on both sides of a lower central portion of the vehicular body 11; a tandem seat 16 is disposed on an upper portion of the vehicular body 11; a steering handle 17 is disposed on the front portion of the vehicular body; a transparent window shield 18 serving as an image screen is raised from the steering handle 17; and the vehicular body 11 is covered with covers such as a front cover 21, a center cover 22, side covers 23, and a rear center cover 24.

[0025] The motorcycle 10 is characterized by including a head-up display 30, which will be described in detail later, wherein an image 31 projected by the head-up display 30 is allowed to be viewed by a driver at an eye position 32 shown by an imaginary line.

[0026] FIG. 2 is a view showing the principle of the head-up display for a motorcycle according to the present invention. The head-up display 30 includes a projector 37 and a projection screen 38 composed of an inner surface, on the driver side, of the window shield 18. The projector 37 is formed by putting a circuit board 34 and a plurality of light emitting devices 35 arranged in series in the direction perpendicular to the paper plane of FIG. 2 in a case 33, and closing the case 33 with a lens 36. In this head-up display 30 having such a configuration, light rays 41 emitted from the light emitting devices 35 of the projector 37 are made obliquely incident on the projection screen 38 of the window shield 18 at an angle ϕ and reflected from the projection screen 38 at the same angle ϕ ; and the reflected light rays (designated by reference numeral 42) travel toward the eye position described with reference to FIG. 1.

[0027] The projection screen 38 having a sufficient reflecting function can be obtained by forming the window shield 18 from a colorless, transparent material or a colored, transparent material. Alternatively, the projection screen 38 may be configured as a screen, called a half mirror, having a transparent function serving as a reflection function. The half mirror treatment can be easily performed by vapor-depositing a thin film made from a metal oxide on the window shield 18.

[0028] The projector 37 is placed on a terrace 44 extending from a back surface of a meter 43 and is covered, together with the meter 43, with a meter cover 45. With this configuration, the projector 37 can be protected by the meter cover 45 for protecting the meter 43.

[0029] A relationship between the image 31 formed by the head-up display 30 and a visual field for a driver will be hereinafter described in detail.

[0030] FIG. 3 is a view illustrating a central field, which is defined as a clearly visible region of a visual field for a driver riding on the motorcycle according to the present invention. During running of the motorcycle 10, the driver whose eyes are located at the eye position 32 sees the front side with his or her visual line tilted slightly downwardly. As is well-known, if a visual line of a human being (whose eyes are assumed to be located at the eye position 32) is offset from the center of the visual field by a small angle $\theta 1$ (about 3°), the visual acuity is rapidly reduced. That is to say, a region surrounded by two lines offset from a center line 47 of the visual field by the angle $\pm\theta 1$ becomes the clearly visible center field. In addition, since the field center line 47 and the center field differ depending on differences in feature (for example, body dimension) between a large number of drivers, the center field capable of covering 90% of a large number of drivers called "90% center field". Accordingly, in FIG. 2, the region surrounded by the two lines offset from the field center line 47 by the angle $2 \times \theta 1$ becomes the 90% center field 48. The 90% center field 48 is positioned over the image 31.

[0031] FIG. 4 is a view illustrating a peripheral field, which is defined as a dimly visible region of a visual field for a driver riding on the motorcycle according to the present invention. During running of the motorcycle 10, the driver whose eyes are located at the eye position 32 dimly sees an object in a region surrounded by two lines offset from the field center line 47 by the angle $\pm \theta 2$, which region is located to cover the 90% center field 48. Both portions, located outside the 90% center field, of this region are called "peripheral fields 49". The angle $\theta 2$, which defines the peripheral field 49, is known as about 75°. However, since a driver riding on a motorcycle wears a helmet on his or her head, the angle $\theta 2$ must be made slightly small as shown in FIG. 4 in order that an edge and a brim of the helmet do not interfere with the peripheral field 49. The peripheral fields 49, however, sufficiently wide to the extent that the bottom edge of the peripheral fields 49 is overlapped to the meter 43.

[0032] FIG. 5 is a view showing the principle of control of the head-up display of the present invention. The motorcycle 10 includes an antenna 51, a receiver 52, a control system 53, an illumination intensity control unit 54, and an illumination intensity sensor 55. The receiver 52 receives radio waves transmitted from another movable

11/20/2002, EAST Version: 1.03.0002

body 56 via the antenna 51, and the control system 53 analyzes the information thus received. If it is decided by the control system 53 that the movable body 56 running in the direction facing or crossing the running direction of the vehicle concerned is present, the light emitting devices 35 are turned on via the illumination intensity control unit 54. At this time, a horizontal row of the images 31 emerge on the window shield 18 as a screen. At the same time, the control system 53 transmits a voice signal by radio transmission via a voice signal generating unit 58. A miniature receiver 62 receives the voice signal via a miniature antenna 61 additionally provided on a helmet 59, and a speaker 63 built in the helmet 59 generates an alarm sound.

[0033] The illumination intensity sensor 55 detects an intensity of illumination in the surroundings, and the illumination intensity control unit 54 adjusts an output of each of the light emitting devices 51 on the basis of a detection signal, to adjust the brightness of the images 31. With this adjustment, the images 31 are made visible in cloudless or cloudy weather, or at night.

[0034] In this embodiment, the receiver 52 receives a signal transmitted from the movable body 56 and the control system 53 recognizes the presence of the movable body 56. The receiver 52, however, can receive a signal for warning, which is transmitted from means fixed on the ground, such as a traffic control sign or a guard rail, along a general road. Such various kinds of transmission information are generally called "traffic information".

[0035] FIG. 6 is a view, seen from the driver side, of the image formed on the screen of the window shield. As described with reference to FIGS. 3 and 4, the 90% center field 48 is present in the vicinity of an upper edge of the window shield 18, and the large peripheral fields 49 are present on the upper and lower sides of the center field 48.

[0036] According to this embodiment, it is important that the image 31 is present in the peripheral fields 49 outside the 90% center field 48.

[0037] In the case where the image 31 is located outside the 90% center field 48, it does not obstruct the drive of the vehicle, and in the case where the image 31 is located in the peripheral fields 49, it allows a driver to dimly see the shape of the image 31 and thereby recognize the presence of the image 31. For this reason, the image 31 is located in the peripheral fields 49.

[0038] Preferably, the image 31 is located in one of the peripheral fields 49 at a central position 65 or a position offset to the center field 48 from the central position 65. The reason for this is that the image 31, which is located in the dimly visible peripheral filed 49, particularly, at the central position 65 or a position offset to the center field 48 from the central position 65, can be more easily recognized by a driver.

[0039] In this embodiment, the image 31 is configured to have a stripe or linear pattern composed of a plurality of (five, for example) dots. The image 31 may have a pattern of dots each of which is formed into a shape similar to a silhouette of a car or a truck. However, in the case where the pattern is complicated, it is required to prepare a complicated, expensive projector for forming the image 31 having such a complicated pattern. Further, if the image 31 having a complicated pattern is located in the peripheral field 49, a driver cannot identify the detail of the complicated pattern of the image 31. From this viewpoint, the image 31 may have a stripe or linear pattern formed by arranging a plurality of dots. The image 31 having a stripe or linear pattern is easier to be recognized by a driver as compared with the image 31 having a dot pattern. Additionally, the image 31 having a stripe or linear pattern is advantageous in production cost because it can be easily formed by collecting dots.

[0040] FIG. 7 is a view illustrating the image formed according to the present invention. As a result of examination by the present inventors, it has been found that even in the case where an image is present in the peripheral field 49, if the image is small, it is difficult for a driver riding on the running motorcycle to recognize such an image. From this viewpoint, the running experiments have been repeated, and eventually it has been found that as shown in FIG. 7, letting an angle formed between two lines extending from an uppermost point of the center field 48 to both ends of an image be $\theta 3$ and an angle formed between two lines extending from a lowermost point of the center field 48 to both the ends of the image be $\theta 4$, if each of the angles $\theta 3$ and $\theta 4$ is 20° or more, the image can be desirably recognized by a driver. Here, as is apparent from this figure, the angle $\theta 3$ is smaller than the angle $\theta 4$. Accordingly, a width W of the image 31 may be set so that the angles $\theta 3$ and $\theta 4$ satisfy a relationship of $20° \leqq \theta 3 < \theta 4$. The width W can be easily set by adjusting the configuration (for example, the dimension in the direction perpendicular to the paper plane of FIG. 2 and the number of the light emitting devices 35) of the projector 37 shown in FIG. 2.

[0041] In this way, one specific feature of this embodiment is that the image has a stripe or linear pattern extending in the horizontal direction and the length (width W) of the image is determined so that an angle formed between two lines extending from a point in the central field to both ends of the image becomes at least 20°.

[0042] An image having a pattern extending longer in the vertical direction tends to easily enter the eyes of a driver and thereby interfere with the driver's view when the driver moves the eyeballs right and left. According to the above feature, however, since the image has the pattern extending longer in the horizontal direction, it does not interfere with the driver's view when the driver moves the eyeballs right and left, and further, since an angle formed between two lines extending from a point in the central field to both the ends of the image is set to at least 20°, the visibility can be enhanced.

[0043] In the above-described embodiment, the motorcycle to which the present invention is represented

11/20/2002, EAST Version: 1.03.0002

by a scooter-type motorcycle; however, it may be represented by a saddle-type motorcycle.

[0044] In the above-described embodiment, the window shield is used for the projection screen; however, any member may be used for the projection screen insofar as an image can be projected thereon. However, if a motorcycle includes a window shield, the use of the window shield as the projection screen is preferable in terms of reduction in the number of parts. Further, in the above-described embodiment, the projection screen is provided in front of a riding position of a driver; however, it may be provided at an arbitrary position.

[0045] It is to be noted that, in the inventions described in claims 1 and 2, the shape of the image is not specified.

The invention provides a head-up display suitable for a motorcycle.

[0046] An image 31 is present in peripheral fields 49 outside a 90% center field 48. In the case where the image 31 is located outside the 90% center field 48, it does not obstruct the drive of the vehicle, and in the case where the image 31 is located in the peripheral fields 49, it allows a driver to dimly see the shape of the image 31 and thereby recognize the presence of the image 31. For this reason, the image 31 is located in the peripheral fields 49.

[0047] Since an image is located in a peripheral field, the presence of the image can be recognized by a driver while not obstructing a desirable visibility to the front side of the driver. The driver can recognized, on the basis of the presence or absence of the image, whether or not attention should be taken to drive of the vehicle.

Claims

1. A head-up display for a motorcycle, which is adapted to inform a driver of traffic information by means of an image (31) projected on a screen (18) provided in front of a riding position of a driver, **characterized in that**

   when a visual field for a driver who takes a riding posture and turns his or her eyes to the front side is divided into a central field (48) and a peripheral field (49) surrounding said central field, said image (31) is located in said peripheral field (49) on said screen.

2. A head-up display for a motorcycle according to claim 1, wherein said image (31) is located at a central position (65) of said peripheral field (49) or a position offset to said central field (48) from the central position (65) of said peripheral field (49).

3. A head-up display for a motorcycle according to claim 1 or 2, wherein said image (31) has a stripe or linear pattern.

4. A head-up display for a motorcycle according to claim 3, wherein said image (31) has a stripe or linear pattern extending in the horizontal direction; and a length of said image (31) is determined so that an angle ($\theta 3$,$\theta 4$) formed between two lines extending from a point in said central field (48) to both ends of said image (31) becomes at least 20°.

11/20/2002, EAST Version: 1.03.0002

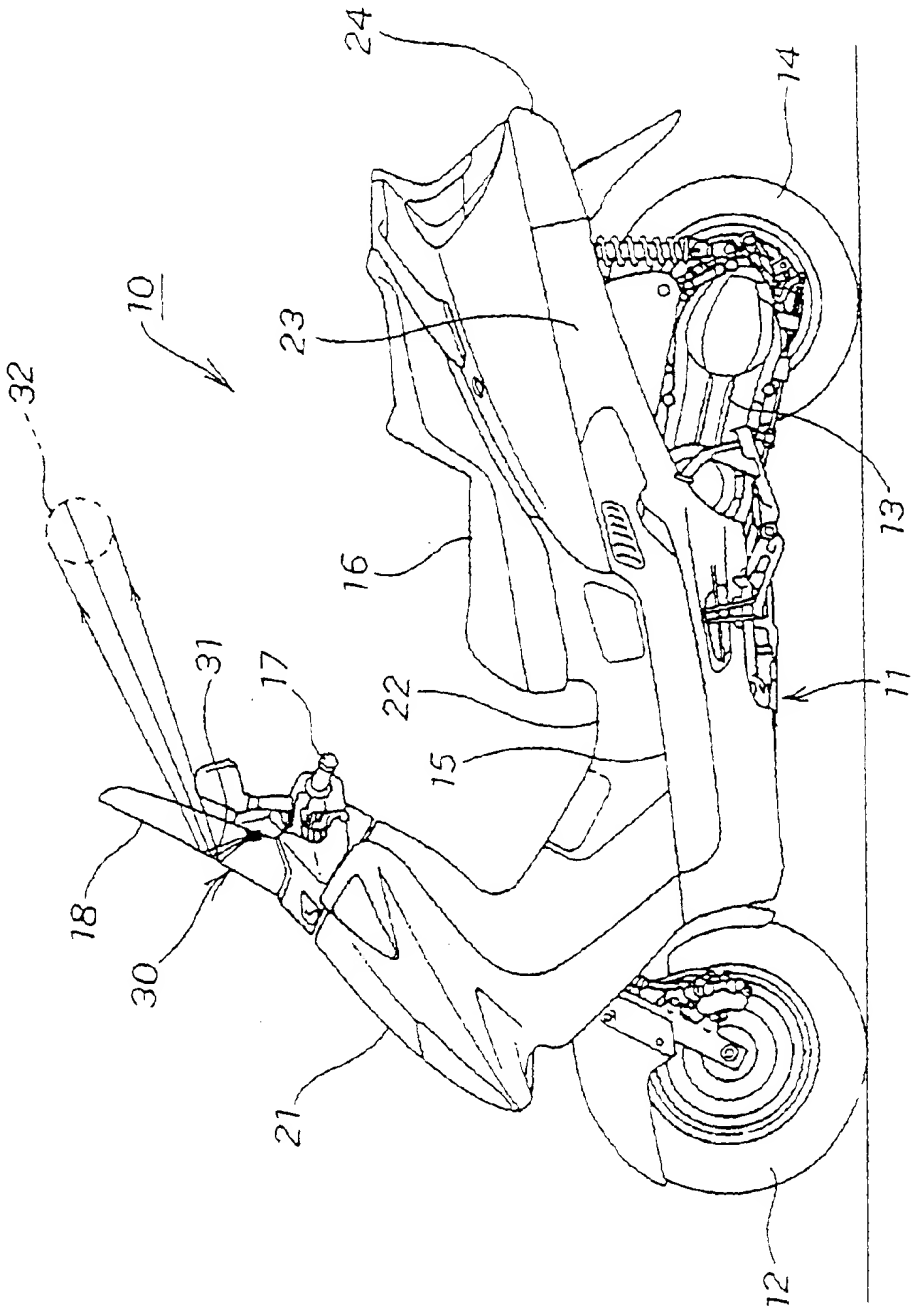

FIG. 1

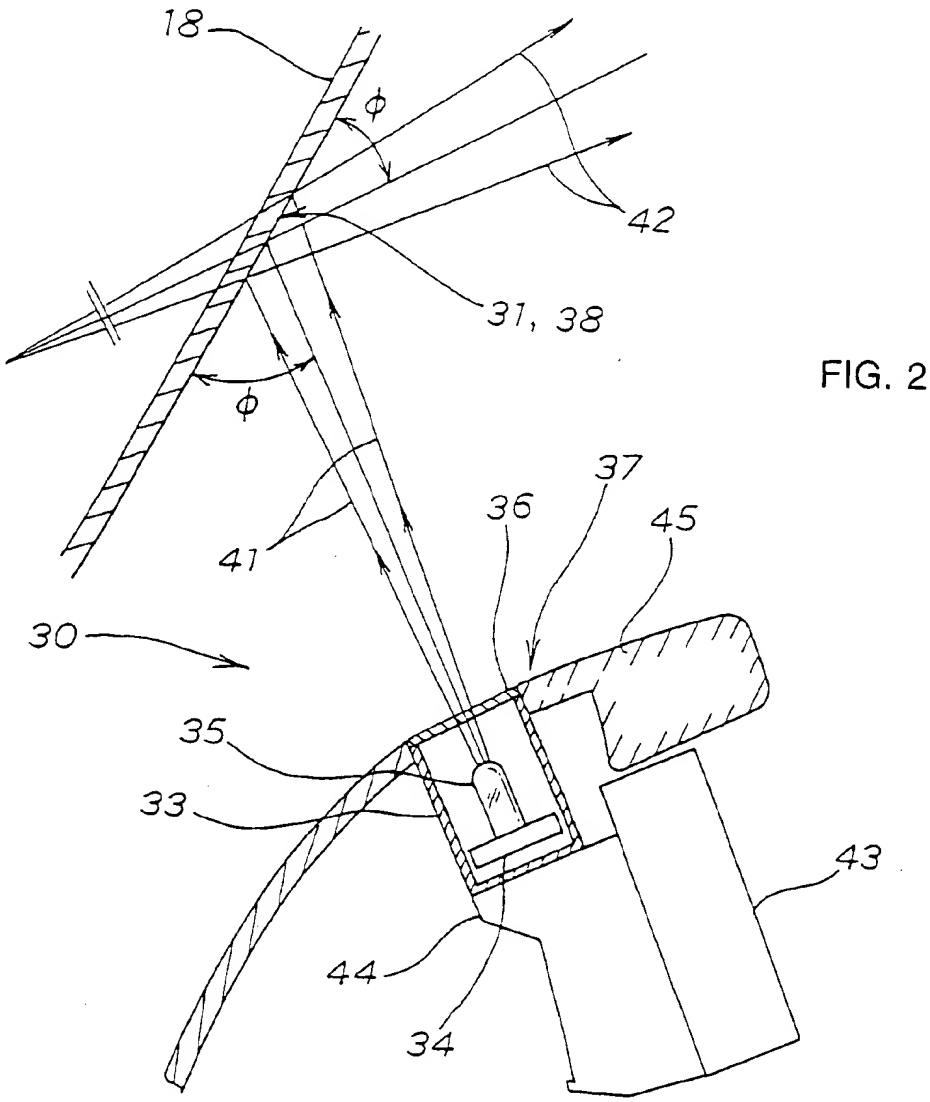

FIG. 2

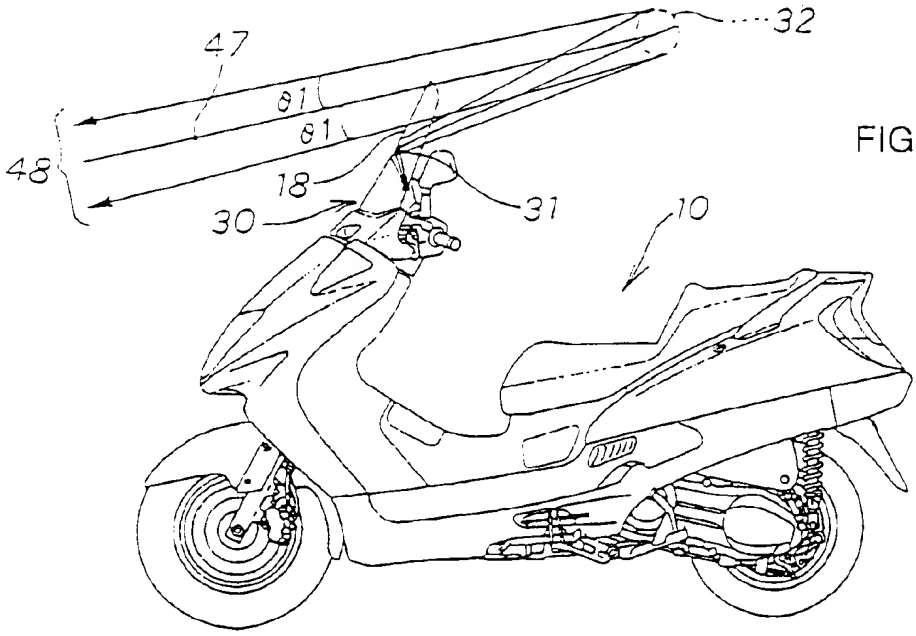

FIG. 3

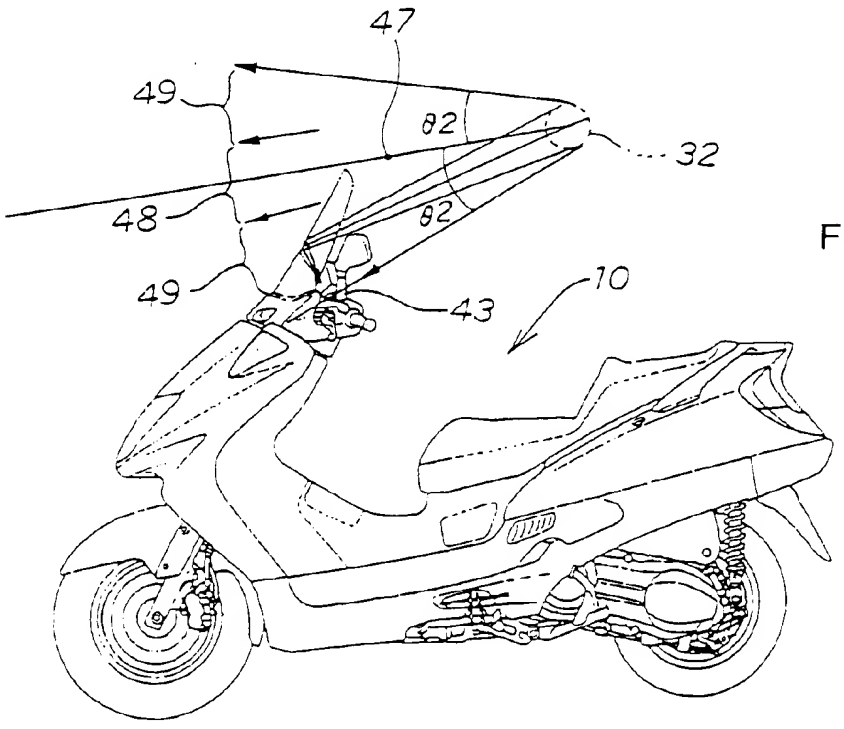

FIG. 4

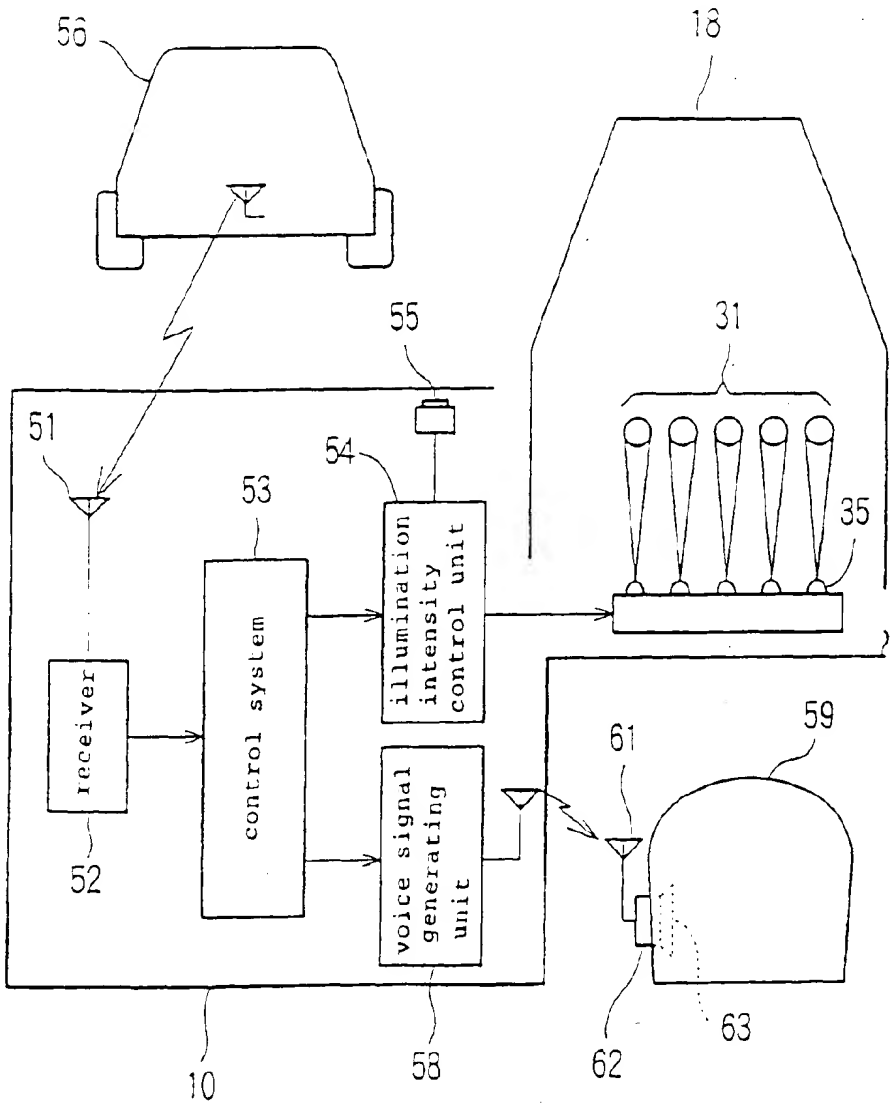
56
18
55
31
51
54
53
35
illumination intensity control unit
receiver
control system
52
voice signal generating unit
61
59
63
10
58
62

FIG. 5

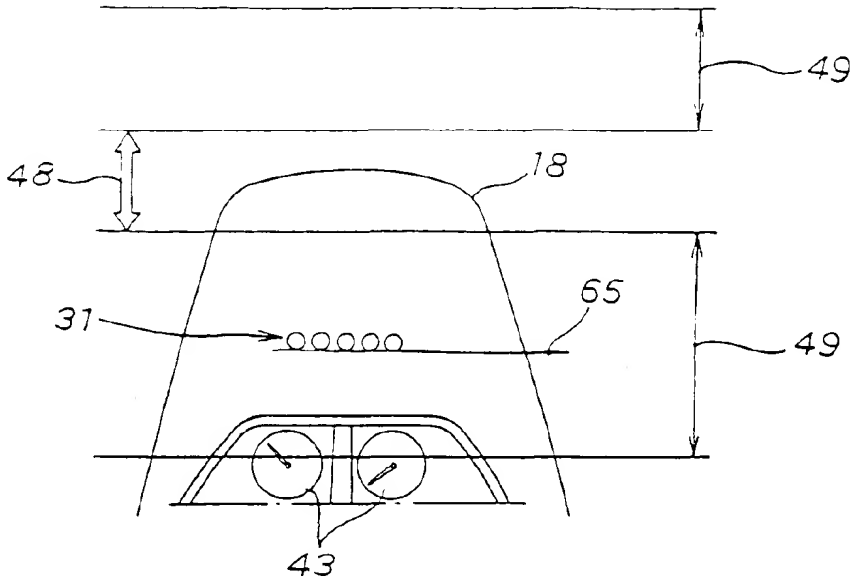

FIG. 6

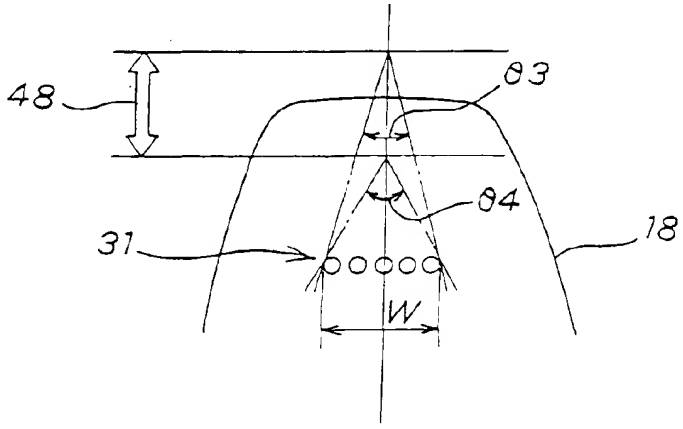

FIG. 7

11/20/2002, EAST Version: 1.03.0002

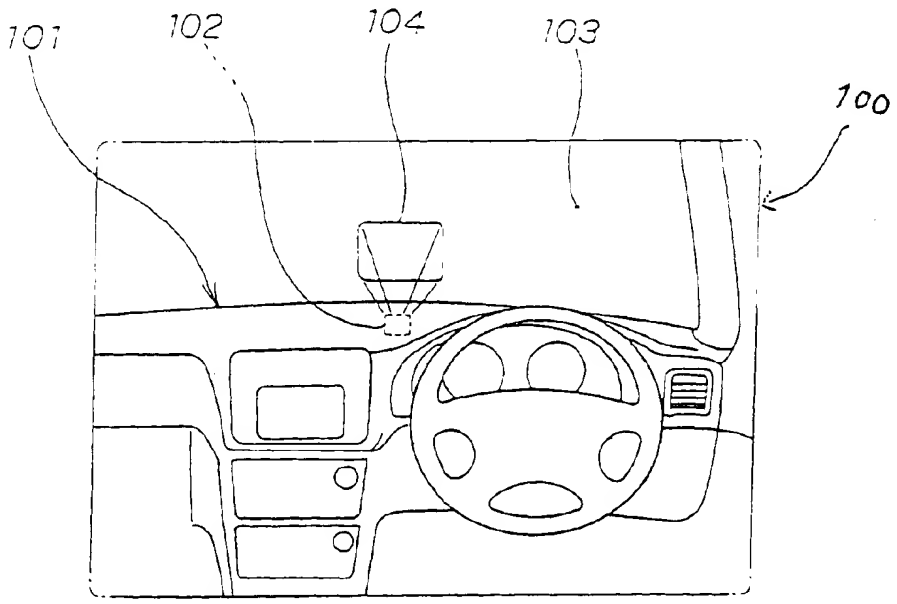

FIG. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 01 10 8295

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 338 703 A (RASAAT) 25 October 1989 (1989-10-25) * abstract * * column 2, line 49 - column 3, line 40; figure 2 * * column 5, line 39 - line 47; figure 5 * ---	1-4	G02B27/01 B62J17/04
X	WO 89 03059 A (FLIGHT DYNAMICS) 6 April 1989 (1989-04-06) * page 9, line 29 - page 10, line 11; figure 1 * ---	1,2	
A	MULLINS C A ET AL: "INTEGRATED COLLISION AVOIDANCE VEHICLE" AUTOMOTIVE ENGINEERING,US,SOCIETY OF AUTOMOTIVE ENGINEERS. WARRENDALE, vol. 103, no. 6, 1 June 1995 (1995-06-01), pages 1-4, XP000509409 ISSN: 0098-2571 * page 2, colomn 3 - page 3, column 1 : "Demonstration and test vehicle" -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
G02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	11 July 2001	Soulaire, D

CATEGORY OF CITED DOCUMENTS

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11/20/2002, EAST Version: 1.03.0002

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 01 10 8295

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11/20/2002, EAST Version: 1.03.0002